

The validity and reliability of a commercially available GPS device during running and cycling

ANDY GALBRAITH^{1*}, VOLKAN ISIKGUN¹ & JAMES HOPKER²

¹University of East London, ²University of Kent

*Corresponding author: A.J.Galbraith@uel.ac.uk
@running_science

Recent advances in technology have led to the development of wearable global positioning systems (GPS). GPS allows for the analysis of physical demands across various sports (Aughey, 2011, *International Journal of Sports Physiology and Performance*, 6, 295-310). The validity and reliability of GPS devices are therefore crucial in providing users with both accurate and consistent data. This study aimed to determine the validity and reliability of a commercially available GPS device. Following institutional ethics approval, one male runner (age: 31years; mass: 72kg; stature: 187cm) was recruited. The participant completed 10 runs at 5, 10 and 15 km.h⁻¹ whilst wearing two Garmin Forerunner 310XT GPS watches on the wrist of the right hand (Garmin International, Kansas, USA). Thirty trials were conducted during running, whilst another 30 were conducted riding a bike, on the outside line of lane one on a 400m athletics track. A 3-min rest was given between trials, and 30-min between speeds. This testing format was replicated over 10 different days, with one trial being performed at each speed per day. Trials were conducted at the same time of day (± 2 h) within a 3-week period. Data from the GPS device were compared to the actual track distance, which was calculated using a Trumeter 5500 measuring wheel (Trumeter Company Inc, Florida, USA). No significant difference was found between the distance reported by the two watches ($P=0.90$), or over the three speeds ($P=0.25$). However, a significant difference was found between watch distance, and actual distance when running ($P<0.01$). The overall mean distance reported by the watch across all trials whilst running was 412.9m (± 4.2), indicating an overestimation of the actual distance (406.9m) by 1.5%. In comparison, the mean distance recorded by the GPS device across all trials on the bike indicated an underestimation of the actual distance by 0.1% (406.4m ± 6.0). No significant difference was found between watch and actual distance when on the bike ($P=0.49$). The typical error, expressed as a CV%, showed that across the within-day reliability trials (mean CV 0.7%; range 0.4-1.2%) and between day reliability trials (mean CV 0.8%; range 0.5-1.5%) there was a good level of reliability (Duthie, Pyne, and Hooper, 2003, *Journal of Human Movement Studies*, 44, 259–271). These results indicate that the GPS watch is a valid and reliable way of measuring distance across a range of velocities. The slight overestimation of distance during running may be due to arm movement.